

Managing Important Recreational and Commercial Shellfish Fisheries Around Harmful Algal Blooms

Dan L. Ayres and Heather J. Reed

Washington Department of Fish and Wildlife

Abstract

The two most important shellfish harvest activities that occur along the Pacific Coast of Washington State are the recreational Pacific razor clam (*Siliqua patula*, Dixon 1789) and commercial Dungeness crab (*Cancer magister*, Dana 1852) fisheries. Participants in these two major fisheries have found their activities disrupted during the 2002-2003 fishing seasons by sudden increases in domoic acid levels in the tissues of these two shellfish species. For what will likely be the third time since its west-coast discovery in 1991, domoic acid has closed the culturally and economically important razor clam fishery, for at least one-year. The entire recreational seasons of 1991-1992 and 1998-1999 and 2002-2003 (to date) have been closed to protect the health of consumers from this potentially deadly toxin. These closures have resulted in a conservative estimate of more than \$20 million lost to the economies of already struggling coastal communities. In February 2003, the viscera of Dungeness crab taken in the coastal commercial fishery that occurs within Willapa Bay, Washington, exceeded the action level for domoic acid. The Willapa Bay fishery was closed immediately, resulting in the loss of fishing grounds to more than 20 active fishers. This marked the first time since 1991 that the Dungeness crab fishery has been affected by domoic acid. In addition, there have been several “close-calls” during the 2002-2003 coast-wide Dungeness crab fishery (that opened December 10, 2002) with crab samples testing very close to domoic acid action criteria. This season with more than 200 active fishers, this fishery is expected to have an ex-vessel value close to \$60 million before it closes on September 15, 2003. Washington Department of Fish and Wildlife (WDFW) and Department of Health staff have met with industry representatives to develop a plan should the action level be exceeded. Currently, WDFW is actively participating in the federally funded Olympic Region Harmful Algal Bloom (ORHAB) project. This study provides the hope of developing an “early-warning” system to avoid the massive disruptions caused by last-minute fishery closures, while still protecting the health of thousands of consumers.

The two most important shellfish harvest activities that occur along the Pacific Coast of Washington State are the recreational Pacific razor clam (*Siliqua patula*) and commercial Dungeness crab (*Cancer magister*) fisheries. Stakeholders in these two major fisheries have found their activities disrupted during the 2002-2003 fishing seasons by sudden increases in domoic acid levels in the tissues of these two shellfish species.

These stakeholders include: the thousands of recreational fishers who participate in the extremely popular razor clam fishery; the hundreds of business owners who greatly benefit from the money spent by clam diggers that stay overnight or pass through Washington’s small coastal communities; the many tribal fishers who harvest razor clams for both commercial and subsistence purposes; the 200 licensed Dungeness crab fisherman whose livelihood depends on this highly valued commercial product; the owners of the crab processing and distributing facilities and their hundreds of employees; and lastly, the state agency fisheries biologists charged with managing these important activities around the constant threat posed by HAB events.

The coastal razor clam and Dungeness crab fisheries are most affected as a result of HAB events that produce the toxin, domoic acid. Razor clams that feed on the harmful algae are not themselves affected, but concentrate the toxins in their meat tissue. When human consumers eat this meat, they also ingest the toxins and can then develop amnesic shellfish poisoning (ASP) that can cause severe illness or death. Because Dungeness crab often feed on razor clams, they also ingest and concentrate the toxin in their viscera. The consumption of crab viscera is a common practice of some consumers putting them at risk of developing ASP.

As this is written, the entire razor clam fishery in Washington State is closed, as it has been since October 2002, due to high levels of domoic acid. This represents an estimated \$10 million loss to the already depressed economies of these small coastal communities. This is the third year-long closure of this key fishery due to elevated domoic acid levels since 1991. In addition, the coastal Dungeness crab fishery—with an expected ex-vessel value (price paid to the fisherman) of



Photo 1. Recreational razor clam diggers (*WDFW photo*)



Photo 2. Commercial crab pot (*WDFW photo*).

nearly \$60 million dollars this season (December 10, 2002 through September 15, 2003)—has been closed in one area, with the possibility of additional closures in the near future.

Two Washington State agencies work closely to monitor for HAB events. The Washington Department of Fish and Wildlife (WDFW) manages the fisheries while the Washington Department of Health (WDOH) biotoxin program is charged with protecting public health by monitoring marine toxins found in the tissue of shellfish harvested in these fisheries. WDFW collects regular samples of both razor clams and Dungeness crab and transports them to the WDOH Public Health Laboratory in Seattle. WDOH then analyzes the toxin levels in the shellfish tissues and reports back to WDFW. When those levels require action, staffs from both agencies work to quickly notify affected stakeholders as soon as possible. For a razor clam closure, this can include WDFW enforcement and biological staff physically staffing roadblocks to turn back harvesters headed to the 60 miles of razor clam beaches found along the Washington coast.

Since the summer of 2000, Washington State has been the recipient of a grant from NOAA Centers for Coastal Ocean Science MERHAB (Monitoring and Event Response for Harmful Algal Blooms) Program. This additional funding has allowed WDFW shellfish managers to set up a plankton-monitoring program to augment clam testing on the beach. A federally funded state-employed technician makes regular collections of plankton samples from waters adjacent to productive razor clam beaches and Dungeness crab grounds. This technician then analyzes the collected samples to determine the presence of plankton species and toxic cells, which in sufficient numbers, could lead to a HAB event. The data received from this monitoring program has allowed managers to have advance notice of pending problems with HAB events allowing WDFW to provide all affected stakeholders time to adjust their activities and make business plans to avoid the serious disruptions that have occurred in past years.



Photo 3. Beach closed signs (*WDFW photo*).

Washington State's MERHAB grant has also allowed WDFW to be a part of the larger collaborative effort of several state, tribal, federal and private partners under the umbrella of the Olympic Region Harmful Algal Bloom (ORHAB) Project. (ORHAB partners include: National Marine Fisheries Service/Northwest Fisheries Science Center, Quinault Indian Nation (QIN), Makah Tribe, Olympic Coast National Marine Sanctuary, Washington Department of Health (WDOH), Washington Department of Ecology, University of Washington's Olympic Coast Natural Resources Center and School of Oceanography, Pacific Shellfish Institute, Battelle Marine Sciences Laboratory, and the Saigene Corporation) (Toni-for some reason I can't seem to eliminate the extra line spacing here. Can you do your magic?). Other ORHAB participants are funded either directly by MERHAB or by a MERHAB grant funneled through NOAA-Fisheries Northwest Fisheries Science Center (NWFSC) in Seattle. The ORHAB project has allowed state and tribal technicians to receive high-quality training from world-renowned scientists at both NWFSC and the University of Washington. Besides providing local (state and tribal) technicians with instruction in the complicated field of plankton identification, ORHAB has also brought the advanced expertise of other partners to the table to look at additional ways of monitoring for HAB events.

One major goal of the ORHAB project has been to develop and implement rapid detection technologies to complement current monitoring strategies to offer the best protection from human exposure to toxins. This technology offers the promise of allowing field staff to determine the presence of toxins in shellfish tissue without having to wait for the current time-consuming transport of samples to a distant laboratory and the subsequent testing that occurs on their arrival.

A satellite remote sensing component of the ORHAB project has facilitated the development of satellite/GIS tools to enhance the monitoring of HAB events along the outer Washington coast. Satellite imagery has already been successful in delineating and tracking water masses associated with toxin-producing organisms off of our shoreline. This technology holds great promise in determining whether a toxic bloom will move into the near shore environment and increase toxin levels in shellfish.

ORHAB partners are working closely with federal scientists from the Olympic Coast National Marine Sanctuary to develop a series of moored buoys along the Washington coast. These buoys will carry equipment to measure seawater temperatures and salinity levels at various depths and some will carry current meters and instruments to measure

chlorophyll levels. These parameters will help track the movement of harmful algal blooms from offshore to near shore waters. A variety of funding sources have been used to develop and maintain these buoys. This work also holds the promise of providing managers advance notice of pending HAB events.

In August of 2002, several of our ORHAB partners successfully secured a five-year, multi-million dollar grant from federally funded ECOHAB program. This work will dovetail with the work begun by ORHAB, providing even better tools to predict HAB events. While neither the Washington Department of Fish and Wildlife nor the Washington Department of Health are directly involved in this ECOHAB Pacific Northwest study, we will be direct beneficiaries of the science that is generated.

How will these new technologies help state fishery managers on a day-to-day basis as we decide whether to open or close fisheries based on the presence or absence of marine toxins? The answer is that the sooner we know of an impending problem with a HAB event, the sooner we can react. The plankton monitoring data we currently collect provides us about a two week "heads-up" allowing us to notify clam harvesters and coastal business owners that the season may not open on time, or there may be an early closure. The information also gives us an idea of the geographical scope of a pending problem, helping us understand whether it is a coast-wide event or more localized. All of this enhances our current ability to manage these fisheries. However, the promise of larger scale technologies like offshore moorings equipped to provide real-time monitoring of key HAB predictors and satellite telemetry that could monitor oceanographic conditions that may lead to HAB events is truly exciting. If fishery managers had two-months notice of a pending problem, it could then be possible to re-adjust season openings to take advantage of at least some harvest opportunities before the toxin is ingested by the shellfish and the fisheries must close. These harvest opportunities would lessen the blow to the various stakeholders who depend on these fisheries.

The State of Washington is grateful for the attention paid by the federal government to assist us with these harmful algal blooms. NOAA-Fisheries scientists from the NWFSC have worked closely with WDFW fisheries managers since the closure faced in 1991 when domoic acid was first found in razor clam tissue. With no funding assistance from the State, these experts came alongside us to help us understand the scope and nature of the HAB event we were experiencing. These same federal scientists have played a key role in forming the ORHAB collaboration and assisting us in securing the MERHAB funding. The MERHAB staff has been outstanding in monitoring our activities including highlighting our work on their web site.

Even though the highest level of domoic acid ever found in razor clams was reported in Washington State in 1998, to date there have been no deaths or serious illnesses attributed to a HAB event along our outer coast (there have been numerous documented illnesses and three deaths due to paralytic shellfish poisoning in Puget Sound). However, the economic impacts of the closures necessary to protect human health have been significant. There is nothing we would like better than to have the threat presented by harmful algal blooms disappear; however, that is unlikely to happen. Nevertheless, it remains the goal of WDFW to continue to provide safe and productive shellfish harvest opportunities for the citizens of our state and to maximize the economic benefits of those harvest opportunities, as we continue to learn to manage our shellfish fisheries around the very real threat of harmful algal blooms.